Apparatus for cutting an oval hole in the wall of a pipe

The invention relates to an apparatus for cutting an oval hole in the wall of a pipe, said apparatus comprising a baseplate with elements for securing a pipe to be cut, a carriage supported on top of the baseplate for linear movement along runners, a drive pulley driven by a power unit and having an opening for a tool and an internal toothed rim meshing with an external toothed rim of the tool for rotating the same, a gear meshing with a second toothed rim of the tool for rotating it slowly, whereby a cutter head is carried by said slow rotational motion relative to the carriage along a circular path, the cutter head rotating at the same time about its own axis as a result of the relative difference in rotational speeds of the toothed rims.

The Applicant has used such an apparatus for a long time and it has proved highly beneficial. It is an object of the invention to develop this prior known apparatus further, such that the desired ovality or ellipticity of a hole is achieved with a simple and reliable mechanism, whereby the degree of ovality or the ratio between the major and minor axes of an ellipse is also readily adjustable.

This object is fulfilled by means of features as defined in the characterizing clause of the appended claim 1. Preferred embodiments of the invention are set forth in the dependent claims.

One exemplary embodiment of the invention will now be described in more detail with reference to the accompanying drawings, in which

Fig. 1 shows in a plan view an apparatus of the invention regarding essential components, yet a tool 20 adaptable to the apparatus being shown in a side view,

Fig. 2 shows an essential part of the invention in a section at a shaft 12 in fig. 1, and

Fig. 3 shows an elliptical hole b made with an apparatus of the invention.

The apparatus comprises a baseplate 1 provided with elements 18 for securing a pipe to be cut underneath the baseplate 1. A carriage 2 is supported on top of the baseplate 1 for linear movement along runners 3. Any linear bearings can be used, either slide bearings or those provided with rolling elements. On the carriage 2 is rotatably bearing-mounted a drive pulley 4 having an opening 8 for the tool 20. The centre axis of the opening 8 intersects that of a pipe to be cut and is perpendicular thereto. The drive pulley 4 is rotated by means of a chain or cogged belt 6, which is meshed with a cogwheel 5 encircling the drive pulley 4.

The drive pulley 4 has the inner surface of its opening 8 provided with a toothed rim 9, which is meshed with an external toothed rim 19 of the tool 20 for rotating the same relative to the body and a toothed rim 23 of the tool 20. This rotation of the toothed rim 19 drives a cutter head 24 about its own axis. A gear 22 meshes with the second toothed rim 23 of the tool 20 for rotating it slowly with respect to the carriage 2. The cutter head 24 is carried by rotation of the toothed rim 23 slowly along a circular path with respect to the carriage 2 of the apparatus.

A cogged wheel 10 is mounted for rotation along with the drive pulley 4. A cam roller 11a present at the end of a cam lever 11 follows a cam surface of the cogged wheel 10, whereby, as the drive pulley 4 is rotating, the cam lever 11 turns slowly away from the centre axis of the drive pulley 4 until reaching a transition point shown in the figure, at which the cam lever 11 makes a quick return by the retraction or expulsion of a spring (not shown) as the cam roller 11a proceeds to the lowest point of the cam surface.

The cam lever 11 is fitted on a shaft 12a with a freewheel clutch 13, having its sense of rotation selected such that a gear 21 mounted on the shaft 12 rotates slowly in the arrow-pointed direction. The shaft 12 is fitted on the carriage 2 with a second freewheel clutch 14. The senses of rotation allowed by the freewheel clutches 13, 14 are opposite to each other. Thus, in each revolution of the drive pulley 4, the gear 21 proceeds through a rotational angle which corresponds to a swing angle of the cam lever 11, which is determined by the rising distance of the cogged wheel's 10 cam surface over each revolution. The toothed rim 23 of the tool 20 is rotated by the gear 21 through the transmission of the gear 22.

In addition to this, the shaft 12 has its rotary motion adapted to work the carriage 2 back and forth in relation to the baseplate 1. A round-trip displacement 2xa corresponds to a difference between the major axis and the minor axis of a desired ellipse, as detailed in figs. 2 and 3. For this reciprocating movement, the shaft 12 has its bottom end provided with a crank 15 in engagement with an opening 16 of the baseplate 1, which is elongated in the direction perpendicular to the runners 3. The crank 15 comprises a roller, having its attachment in a transverse groove 17 of a flange present at the shaft's 12 bottom end. By displacing the attachment of the crank 15 in the groove 17, it is possible to adjust a length a of the crank lever while simultaneously adjusting the degree of ovality for an elliptical hole b to be formed, i.e. its deviation a from a circle c.

The combined use of slow rotation and reciprocating linear motion by means of the shaft 12 ensures further the fact that the movement of the cutter head 24 in its circular path c is always synchronized to a deviation from this path c inflicted by a linear displacement for establishing an ellipse.

The invention is not limited to the foregoing exemplary embodiment as its structural details may vary within the scope of the appended claims.